CONAXIS – EXAMPLE 2

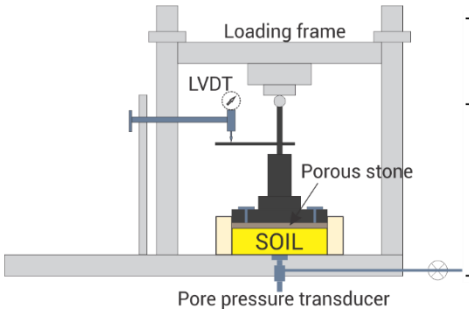
Modelling constant rate of strain test

1. Problem description

For each time step, measured data of a constant rate of strain test (Figure 1) includes four values:

- Testing time (minutes)
- Strain (%)
- Applied vertical stress (kPa) on the top
- Pore pressure at the bottom

Using ASTM D4186, or the back analysis method, we can obtain the curves $K \sim \sigma_v^{'}$ and $k_v \sim \sigma_v^{'}$ where K is the bulk modulus, k_v is the vertical hydraulic conductivity, and $\sigma_v^{'}$ is the vertical effective stress. These curves can be used directly for consolidation analysis.



Time (min)	Strain (%)	Vertical Stress (kPa)	Pore pressure (kPa)
0.00	0.00	0.01	0.01
1.00	0.01	0.22	0.02
2.00	0.02	0.45	0.04
3.00	0.02	0.67	0.06
4.00	0.03	0.89	0.08
5.00	0.04	1.11	0.09

Figure 1: Constant rate of strain test

The file *CRS-test-data.dat* contains test data of a CRS test. In this example, we do:

- Obtaining the curves $K \sim \sigma_v^{'}$ and $k_v \sim \sigma_v^{'}$ by using ASTM D4186, and model again the CRS test with these curves.
- Obtaining the curves $K \sim \sigma_v^{'}$ and $k_v \sim \sigma_v^{'}$ by using the back analysis method.

2. Using ASTM-D4186

Click *File/Constant strain rate test module*, a dialog popups. Click *Browse* to browse the file *CRS-test-data.dat.*

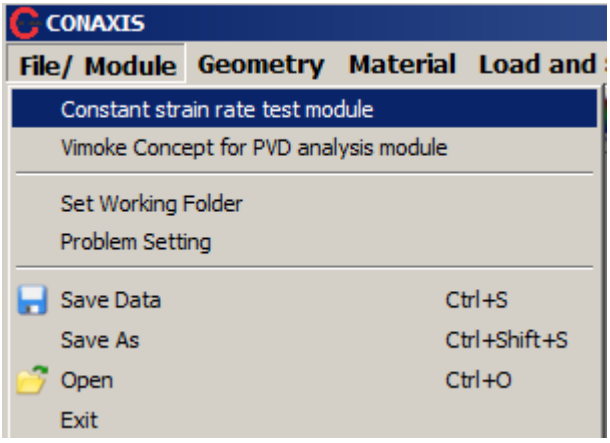


Figure 2: Load CRS test module

A dialog asks for the column indices of the testing time, the strain, the stress, and the pore pressure. In our file, the first column is testing time, the second is the strain, the third is the total stress, and the fourth is the pore pressure. Hence, we input 1,2,3,4 (Figure 3).

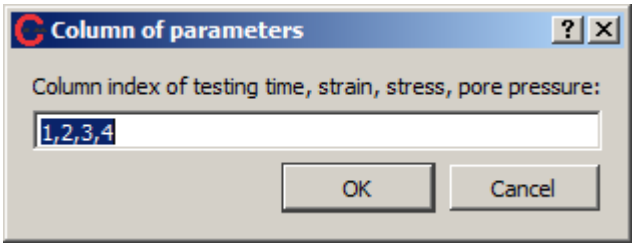


Figure 3: Input column indices

For the output type, we can chose between

- **Effective stress, K, kv:** The output results have only three columns which are effective stress, the bulk modulus, and the vertical hydraulic conductivity.
- **Effective stress, K, kv, mv, cv, void Ratio:** Output results contain more information such as the compressibility m_v, the vertical consolidation coefficient c_v, the void ratio.

The other information we need:

- The initial height of the sample: H_0
- The sample radius R
- The initial void ratio e_0
- The Poisson's ratio υ
- Choosing between using the linear theory or non-linear theory

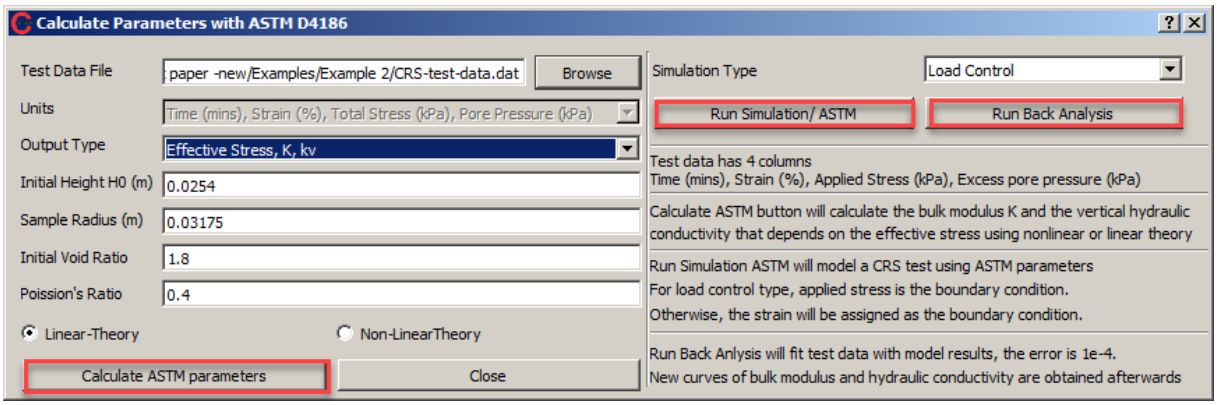


Figure 4: Options for the CRS test

When every information is given, we can:

- Push the button *Calculate ASTM parameters* to obtain the curves $K \sim \sigma_v^{'}$ and $k_v \sim \sigma_v^{'}$ using equations from ASTM D4186
- Push the button *Run Simulation/ASTM* to model the constant rate of strain test using above curves.
- Push the *Run Back Analysis* to run the back analysis process